An apparatus comprising:

- a) a substrate with a surface comprising a plurality of assay locations in a hybridization chamber, each assay location comprising a plurality of discrete sites;
- φ) a population of microspheres comprising at least a first and a second subpopulation, wherein each subpopulation comprises a bioactive agent;

whèrein said microspheres are distributed on each of said assay locations.

10

- 2. An apparatus according to claim 1 wherein each of said assay locations comprises a substantially similar set of bioactive agents.
- 3. An apparatus according to claim 1 wherein said substrate is a microtiter plate and each assay location is a microtiter well.
- 4. An apparatus according to claim 1 wherein each discrete site is a bead well.
- 5. An apparatus according to claim wherein each of said subpopulations further comprise an optical signature capable of identifying said bidactive agent.
- An apparatus according to claim 1 wherein each of said subpopulations further comprise an identifier binding ligand that will bind a decode binding ligand such that the identification of the bioactive agent can be elucidated.

25 -

20

An apparatus comprising:

a) a first substrate with a surface comprising a plurality of assay locations;

b) a second substrate comprising a plurality of array locations, each array location comprising discrete sites;

- c) a population of microspheres comprising at least a first and a second subpopulation, wherein each subpopulation comprises a bioactive agent; wherein said microspheres are distributed on each of said array locations; and
- d) a hybridization chamber configures so as to receive said second substrate.

35

30

8. An apparatus according to claim 7 wherein said first substrate is a mickotiter plate.

57



- An apparatus according to claim 7 or 8 wherein said second substrate comprises a plurality of fiber optic bundles comprising a plurality of individual fibers, each bundle comprising an array location, and each individual fiber comprising a bead well.
- 5 10. An apparatus according to claim 9, wherein said hybridization chamber further comprises at least one component port.
 - 11. An apparatus according to claim 7 wherein each of said subpopulations further comprise an optical signature capable of identifying said bioactive agent.
 - 12. An apparatus according to claim 7 wherein each of said subpopulations further comprise an identifier binding ligand that will bind a decoder binding ligand such that the identification of the bioactive agent can be elucidated.
 - 13. A hybridization chamber comprising:
 - a) a base plate wherein a base cavity for holding a first array component is formed in said base plate;
 - b) a lid comprising at least one component port for immobilizing a second array component;
 - c) a sealant between said base plate and said lid.
 - 14. The chamber according to claim 13, wherein said second array component is a fiber optic bundle.
 - 15. The chamber according to claim 13 further comprising at least one alignment feature.
 - 16. The chamber according to claim 15, wherein said at least one alignment feature is a male and female fitting.
 - 17. The chamber according to claim 13, further wherein said first array component is a microtiter plate.
 - 18. The chamber according to claim 13 further comprising at least one fluid handling device.
 - 19. A method of decoding an array composition comprising
 - a) providing an array composition in a hybridization chamber, said array composition comprising:
 - i) a substrate with a surface comprising a plurality of assay locations, each assay location comprising discrete sites; and



270 1

25



35

25

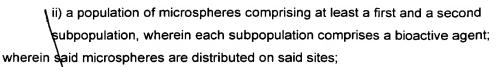
30

35

5

10





b) adding a plurality of decoding binding ligands to said array composition to identify the location of at least a plurality of the bioactive agents.

- 20. A method of decoding an array composition comprising
 - a) providing an array composition in a hybridization chamber, said array composition comprising:
 - i) a substrate with a surface comprising a plurality of array locations, each array location comprising discrete sites; and
 - ii) a population of microspheres comprising at least a first and a second subpopulation, wherein each subpopulation comprises a bioactive agent; wherein said microspheres are distributed on said sites;
 - b) adding a plurality of decoding binding ligands to said array composition to identify the location of at least a plurality of the bigactive agents.
- 21. A method according to claim 19 or 20 wherein at least one subpopulation of microspheres comprises an identifier binding ligand to which a decoding binding ligand can bind.
- 22. A method according to claim 19 or 20 wherein said decoding binding ligands bind to said bioactive agents.
- 23. A method according to claim 19 of/20 wherein said decoding binding ligands are labeled.
- 24. A method according to claim 19 or 20 wherein the location of each subpopulation is determined.
- 25. A method of determining the presence of one or more target analytes in one or more samples comprising:
 - a) contacting said sample with a composition comprising:
 - i) a substrate with a surface comprising a plurality of assay locations, each assay location comprising discrete sites; and
 - ii) a population of microspheres comprising at least a first and a second subpopulation each comprising a bioactive agent, wherein said microspheres are distributed on said surface such that said discrete sites contain microspheres;
 - b) incubating in a hybridization chamber; and
 - c) determining the presence or absence of said target analyte.



A method of determining the presence of one or more target analytes in one or more samples comprising:

- a) adding said sample to a first substrate comprising a plurality of assay locations, such that said sample is contained at a plurality of said assay locations;
- b) contacting said sample with a second substrate comprising:
 - a surface comprising a plurality of array locations, each array location comprising discrete sites; and
 - ii) a population of microspheres comprising at least a first and a second subpopulation each comprising a bioactive agent, wherein said microspheres are distributed on said surface such that said discrete sites contain microspheres;
- b) incubating in a hybridization chamber; and
- c) determining the presence of said target analyte.
- 27. A method of mixing solutions in an array format comprising:
 - a) providing a hybridization chamber comprising:
 - i) a base plate comprising holes, wherein at least two of said holes are joined by a channel;
 - ii) a membrane;
 - ii) a lid comprising at least one component port for immobilizing an array component;
 - iii) a sealant between said base plate and said lid;
 - b) applying a vacuum to said membrane whereby wells are formed in said membrane;
 - c) providing a solution to said membrane whereby said solution enters at least one well;
 - d) intermittently applying vacuum to said membrane, whereby said solution is mixed.
- 28. The method according to claim 15, wherein said solution enters a plurality of said wells.

add A

10

5